Health Public Crisis Impact on Non-Life Insurance: The case of Covid-19

Marta Costa, MSc
NovaIMS
Lisbon, Portugal
m20190254@novaims.unl.pt

Rui Gonçalves, Ph.D.
PIAGET Almada
Almada, Portugal
ruiahgoncalves@gmail.com

Renato Lopes da Costa, Ph.D.
Business Research Unit – BRU-IUL
ISCTE - Instituto Universitário de Lisboa
Lisbon, Portugal
renato.lopes.costa@iscte-iul.pt

Leandro Pereira, Ph.D PMP
BRU-Business Research Unit
ISCTE - Instituto Universitário de Lisboa
Lisbon, Portugal
leandro.pereira@iscte-iul.pt

Álvaro Dias, Ph.D
Universidade Lusófona de Humanidades e Tecnologias
ISCTE - Instituto Universitário de Lisboa
Lisbon, Portugal
alvaro.dias1@gmail.com

Marta Costa is Master Science from Universidade Nova de Lisboa, IMS. She is an expert in publich health with strong soft skills in particular, public speaking, presentation skills and problem solving. During the research role Marta develop a huge knowledge in how public heath impacts society.

Rui Gonçalves holds a PhD in Management from Instituto Superior de Economia e Gestão, with research in information systems for operational risk management, a Master in Statistics and Information Management from NOVA Information Management School (NOVA IMS), with research in the area of Intelligent Agents, and a degree in Business Management from the International University. He is currently a Guest Assistant Professor at NOVA IMS and works as Manager in the Business Expertise division at SAS Portugal. In recent years, he has coordinated the areas of Operational Risk, Compliance, Fraud, Audit and Money Laundering.

Renato Lopes da Costa. PhD in General Management, Strategy and Business Development by ISCTE (Portugal) has articles published in several specialized journals in the East, the United States, Canada, Africa, South America and Portugal. He is currently a researcher and member of BRU-UNIDE and a professor at INDEG where he holds the post of director of the MScBA (Master in Business Administration) and guides students in the development of master's and PhD theses. Teaches business strategy modules in executive and post-graduate master's degrees. Since 2013 he has also accumulated teaching duties as an invited professor at the Military Academy where he teaches the Knowledge Management.

Leandro Pereira is Assistant Professor with Habilitation in Management at ISCTE Business School. He holds a Ph.D. in Project Management. He is also CEO and Founder of WINNING Scientific Management. Dr. Pereira is also former President of Business Case Institute, PMI Portugal Chapter and Training Specialist of the Court of Auditors. As CEO, Dr. Pereira receives from Best Teams Leaders the award of Best Team Leader and CEO of Portugal in 2017 in Portugal. He is also PMP from PMI and ROI certified. As researcher, he published more than 100 scientific publications and 10 books. As student, he received the best student award from University of Minho. Dr. Pereira is an international expert in Strategic Management, Project Management, Benefits Realization Management, and Problem Solving.

Álvaro Dias is Professor of Strategy at Instituto Superior de Gestão and ISCTE-IUL, both in Lisbon, Portugal. He got his PhD in Management from Universidad de Extremadura, Spain, after an MBA in International Business. Professor Dias has over 24 years of teaching experience. He has had several visiting positions in different countries and institutions including Brazil, Angola, Spain, Poland and Finland. He regularly teaches in English, Portuguese, and Spanish at undergraduate, master and doctorate levels, as well as in executive programs. Professor Dias has produced extensive research in the field of Tourism and Management, including books, book chapters, papers in scientific journals and conference proceedings, case studies, and working papers.

ABSTRACT:

The insurance industry plays a crucial role in developing a country's economy, thus becoming one of the main focuses when studying the possible impacts of the current public health crisis. Accordingly, the main objective of this study is to investigate the COVID-19 impact on non-life insurance profitability of the Portuguese insurance sector. This study also intends to assess the explaining factors of insurance companies' profitability on the period between 2004/2020. The methodology implemented was a multiple linear regression, using a panel data model with random effects. The sample consists of a total of 238 observations from 14 non-life insurers over 17 years. The results revealed that COVID-19 positively impacted the profitability of the insurance companies presented. However, this impact was only significant on the return on

assets. Furthermore, the results showed an inverse and meaningful relationship between the profitability ratios and the variables leverage and loss ratio.

Keywords: COVID-19, Insurance Sector, Panel Data, Profitability

1. INTRODUCTION

At the end of 2019, a novel coronavirus, scientifically called SARS-CoV-2, was discovered in Wuhan, China. This coronavirus, causing a disease called COVID-19, became, in a short period, the most discussed topic, not only in Portugal but in the whole world. Given the quick spread of the virus across the globe, the World Health Organization declared it a pandemic in March 2020. COVID-19 has had a huge impact on the global economy, causing large recessions in the financial markets and the different activities and businesses, who were forced to suspend or change their daily operations due to government measures that were implemented. According to Babuna et al. (2020), the high virus spread rate has resulted not only in the closure of borders and businesses globally but has also contributed to the loss of jobs and lives. Therefore, in 2020, the world economy faced a global economic recession. With the shutdown of some financial and commercial sectors, the effects were disastrous, even affecting industries with greater stability and financial strength, such as the insurance industry.

Studying the insurance profitability during a public health crisis is particularly important for several reasons. The insurance activity stands out from other economic activities for its strong intervention in areas of obvious social interest, particularly the protection of people and the management of savers' savings (APS, 2018).

The insurance industry plays a crucial role at the economic and financial levels. The insurance sector is essential for any economy and is an integral part of the financial system, responsible for managing risks, both individual or institutional, crucial in any country's risk management system (Ajao and Ogieriakhi, 2018). In accordance with Pereira da Silva (2000), insurance companies contribute to the capital market stability, increase the economic agents' confidence indices, and are important to the financial system because they allow economic development. The author also reinforces that the insurance activity is a strong economic driver and a support for the economy. Obasi (2010) argues that the insurance sector is a very important component of the financial system since insurance companies invest the large amounts of insurance premiums, they receive from their clients in both short- and long-term investment funds.

Given the high relevance of profitability in the financial management of a company, it was decided to carry out the study of the pandemic impact at the profitability of insurers level. According to Al-Jafari and Samman (2015), company profitability refers to the obtained profits from the total revenues, after deducting all the activity expenses, during a certain period, and it's considered one of the most important goals that each company management strives to achieve, and without it, the companies would disappear. According to Lee (2014), an insurer's profitability not only plays a key role in persuading policyholders and shareholders/investors who provide funds for the company, but also improves its solvency ratio.

Accordingly, the main objective of this investigation is to analyse the impact of the 2020 public health crisis on the profitability of insurance companies, operating in the non-life branch, in Portugal. Additionally, since profitability is extremely important for each firm, knowing the factors that most influence it became very relevant. This way, in this study we also intend to assess which are the profitability explaining factors of the insurance companies under investigation. To carry out the study, we had considered the 14 insurers with the higher market share in Portugal during the period considered and with available data in time for its completion.

Although several researchers tried to assess the possible economic impacts of a pandemic, namely in the insurance sector, these studies have been quite limited due to the inexistence of any severe pandemic in the current century, with the economy, health and technology considerably developed, compared to the last century.

The health system most developed countries have nowadays allows for medical assistance that is totally different from the one provided in the past. Technology continues to develop at a fast pace allowing us to reach new conclusions more quickly. Furthermore, the increase in travels, between countries or cities, and in commercial exchanges makes the impact of a virus more accelerated. Thus, through these studies, based on limited and outdated data (which, for the most part, consist of actual data from past pandemics), the researchers reach very questionable and doubtable models and estimates. Stracke and Heinen (2006) corroborated this idea, stating that it is impossible to reliably predict the outbreak or the effects of a new pandemic: on one hand, medical care has improved since 1918, and on the other, the increase in mobility of the current population would make the virus spread more easily.

This way, the conclusions obtained in this study will contribute to the increase in the literature on the impact of a pandemic on the insurance sector, in the current context, as well as it will enable a better understanding of the behaviour of the financial performance of non-life insurers during a pandemic. Additionally, given that few studies were carried out in Portugal to investigate which factors explain the profitability of insurance companies, especially in severe public health situations, this study will add knowledge and bases for other investigations on the same topic and add value and knowledge to the problem.

2. LITERATURE REVIEW

2.1. PANDEMIC IMPACT ON THE INSURANCE SECTOR

According to EIOPA president, Gabriel Bernardino (2020), we are facing a challenging moment worldwide, both for business and for people. There is great uncertainty surrounding the magnitude of the economic disruption, due not only to the uncertainty regarding the duration of the public health threat, but also to the ignorance on when and how restrictions will be implemented. All these factors contribute to an incredibly unstable global environment. The insurance industry must deal with challenging market conditions, maintaining its operations while protecting its employees and customers.

Globally, the insurance industry is the main global stabilizing force in financially replenishing insured losses. COVID-19 has confirmed the value that insurance contracts can bring for each citizen and for companies. This way, insurers promote peace of mind during particularly difficult times and play a key role in combating the negative socio-economic effects of the pandemic. The public health crisis has created an opportunity to explore the role that insurers can play in boosting the resilience of the economy and society (Global Federation of Insurance Associations, 2020).

Thus, the insurance sector plays a key role in the mitigation of systemic risks under normal conditions and its role is especially important in managing losses following a pandemic or natural disaster. Insurers and reinsurers act as financial intermediaries to ensure the transfer of financial and biometric risks, pandemic risks, natural catastrophes, and man-made disasters. (Loannides, 2020)

According to the Thorburn *et al.* (2020), pandemics ate not considered a “Black Swan” event for insurers, that is, a totally unexpected event with potentially serious consequences. Especially for life and health insurance, pandemics have been considered the highest risk exposures. The required capital that companies operating in the insurance sector must retain already consider pandemic scenarios. However, COVID-19, like any other extreme event, has unique features and has created difficulties in the insurance sector, which need to be overcome.

Several authors mention that the effect of a public health crisis on the insurance industry can be quite significant. However, studies carried out on the impact of a pandemic on this industry are quite limited.

In a pandemic scenario, almost the entire insurance industry will be affected, but the severity of the impact will depend on the duration of the public health threat. The closure of public spaces, such as cinemas or restaurants, public transport, as well as the interruption of supply chains, can increase the number of claims for insurance policies that cover risks related to business interruption. Insurance companies will be affected not only due to the increase in claims numbers but also because the assets they own could lose value. Investments in financial markets would be affected during a pandemic and the economy could enter recession for numerous years. The model developed has anticipated an expected loss of 1.1 billion rands in a mild pandemic case, and if the pandemic were severe, with a magnitude similar to the 1918 pandemic, a loss of 55 billion rands would be expected (Dreyer, Kritzinger and Decker, 2007).

Weisbart (2006) suggested that a mild pandemic in the United States of America, similar to the 1957 Asian flu pandemic and the 1968 Hong Kong flu pandemic, could cost $15 billion to life insurers. The author also stated that a pandemic identical to the one in 1918 would cost $155 billion, due to an increase in deaths.

According to Stracke and Heinen (2006), during a pandemic the insurance companies would incur costs that could range from 2.3 to 43.5 billion. These numbers would depend on the severity of the crisis; the highest number would be reached if the pandemic were similar to SARS. This was one of the few authors that used SARS as a worst-case scenario instead of the Spanish flu, arguing that SARS flu had much higher mortality and lethality rates.

Alm et al. (2006) stated that a pandemic would be worst for life insurers, as the increase in the mortality rate inevitably promotes an increase in losses, for which insurers may not be prepared. On the other hand, the indirect costs arising from economic problems would exceed the direct costs from the increase in claims. The first consequences would appear as a result of the decrease in demand, due to the fact that individuals want to avoid social contact. The authors noted that it was difficult to quantify the impact of a pandemic on the insurance industry, however, it was quite possible that the global downturn in the economy would significantly affect it.

Currently, there are some researchers who focus their investigations on the economic impact of COVID-19 on the various financial sectors, namely the insurance market.

Loannides (2020) noted that the current impact of the coronavirus is being felt on both sides of insurers' balance sheets, noting that London insurer Lloyd's predicts total losses of more than $200 billion for the industry, half of which is attributed to the insurance business in general, and the other half to losses related to the financial markets.

According to the Swiss Re Institute (2020), the COVID-19 pandemic will trigger the biggest recession experienced since 1930, with a 4% contraction in global GDP expected in 2020. The crisis will lead to a drop in the demand for insurance, decreased sales, and reduced income. The decrease in the value of premiums that will occur in life and non-lifelines of business will have a similar magnitude to what was observed during the 2008 financial crisis, despite the contraction in GDP becoming much more severe with the pandemic.

According to KPMG (2020), the effects of a public health crisis are not insignificant for all financial and commercial sectors, but it is necessary to give special emphasis to insurers whose impact can be quite significant. Insurance companies may be burdened with the occurrence of claims or general inquiries in the different branches that comprise it. Regarding non-life insurance, the impact is more difficult to predict, given that most policies exclude coverage in a pandemic scenario. However, there are some policies that do include it, which can lead to problems, like the cancellation of the event. Although the insurance industry is following the evolution of mortality rates, it is expected that it will suffer from what may happen in the financial markets.

According to Babuna et al. (2020), we are in a period of economic recession with reduced profits and increased claims. Due to travel, event cancellations and other economic losses, between March and June 2020, the insurance sector in Ghana experienced a decrease of 17.01% in total premiums and an increase of 38.4% in the number of claims. The estimated loss for the sector is approximately €16 227 billion.

Wang et al. (2020) investigated the impact of COVID-19 on the Chinese insurance market in the short term. The results revealed that the pandemic had a very significant negative effect on insurers operating in the country, due to existing limitations in terms of marketing and the substantial drop in demand for insurance.

Puławska (2021) investigated the impact of the COVID-19 crisis on the European insurance industry and concluded that the pandemic had a negative impact on it. During the pandemic, the return on assets ratio of insurers operating in Europe decreased. In particular, in an analysis carried out at the country level, there was a decrease in the insurers ROA operating in Germany, Italy and in the solvency ratio in the insurance industry in Belgium, France and Germany.

According to McKinsey, since the beginning of the pandemic, the insurance industry has lost, globally, about $760 billion in market capitalization, this being the third highest value found among all industries. According to Accenture, it is estimated that the consequences of the current crisis for the insurance industry will be more extensive and sudden than those of pandemics and economic crises that occurred in the past. The increase in operating costs, combined with a reduction in written premiums, is the most serious consequence. (Klonowska and Strupczewski, 2020)

José Galamba de Oliveira, APS President, referred, in 2020, that the economic impact of this pandemic would be, without a doubt, the most violent experienced by our society since there is memory. The impact was already noticeable in current contracts, with customers requesting suspension of contracts, postponements in the payment of premiums and reduction in the acquisition of new insurance contracts. However, the insurance sector has risk management in its DNA, so it should be one of the best prepared sectors to deal with more or less catastrophic situations. In addition, historically, the insurance market has demonstrated an enormous resilience in crisis of different nature.

According to the APS, the decrease observed in production of direct insurance confirmed that the pandemic crisis had an impact on the Portuguese insurance sector, with the penetration rate (production/GDP ratio) falling to 4.8% in 2020, a value that has not been observed since 2002. Regarding the non-life segment, whose development is most interconnected with the evolution of economic activity, it is possible to say it was the segment that most directly suffered from the impacts of the pandemic, being also the most affected by the implementation of extraordinary mechanisms of default interest and adjustments to insurance premiums. By the end of 2020 there was a substantial drop of 34.8% in production in this branch. (Seguros e Cidadania, 2020)

Within the scope of the COVID-19 pandemic, the ASF implemented a set of measures to ensure the sector stability and the rights of policyholders and beneficiaries, as well as to monitor the evolution of relevant risks. The production of non-life insurance amounted to €5299 million, having registered an increase of 2.9% compared to the previous year, and this increase would have been 4.5% if no measures had been taken. The accident ratio verified during 2020 was, for the total market, of 62.8%, which represents a decrease of 3.2 percentage points compared to 2019. If no measures had been taken, it is estimated that the ratio would be 60.4%. The global technical result of non-life branches totalled €325.3 million, with a technical performance of 6.1% (+2.6 percentage points than in 2019), which would be equal to €477.1 million in case of no implementation of extraordinary measures. (ASF, 2021)

2.2. INSURANCE COMPANIES PROFITABILITY DETERMINANTS

Performance is a concept defined as output of activity of companies and the appropriate measure to calculate performance is considered according to the organization type and objectives of evaluation (Ostroff and Schmidt, 1993).

According to Faga (2006), for companies to be considered profitable, the amount of money that enters must be greater than the amount that exits. This author also states that one of the most relevant business objectives for companies is the acquisition of profitability and it is very important that companies take this into account in order to allow their growth and guarantee their continuation.

All companies aim to maximize their profit, improve their performance and increase their profitability. The profitability of any company not only intends to increase its market value, but also to promote the growth of the entire industry which, in the end, leads to the overall prosperity of the economy. (Ahmed, Ahmed and Usman, 2011)

According to Burca and Batrînca (2014), profitability, defined as a proxy of financial performance, is one of the main objectives of insurance companies' management. Profit is an essential prerequisite for increasing the competitiveness of a company that operates in a globalized market, attracts investors and increases the level of solvency, reinforcing consumers' confidence.

Profitability ratios are indicators of the companies' general efficiency and, therefore, are frequently used as a measure of earnings obtained by the company during a given period. Profitability ratios can measure a firm's earning capacity and can also be used as a measure of growth, success, and control. (Kabajeh et al., 2012)

The analysis of companies' profitability, as well as the factors that determine it, has been subject of several studies. In the particular case of insurance companies, the indicators most frequently used by researchers are return on assets (ROA) and the ratio of return on equity (ROE).

Return on assets ratio is an indicator of the company's profitability in terms of its total assets. This ratio allows us to obtain information about the company's management, namely whether the company was efficient obtaining profits utilizing its assets. ROA is a picture of a company's financial performance, and an increase in this ratio indicates a positive financial performance, and exactly the opposite for the reverse situation. This ratio is obtained through the quotient between net income and total assets (Epps and Cereola, 2008). Among the revised literature, ROA is always used in the study of the financial performance of insurance companies.

Return on equity ratio is the most relevant from the perspective of the partners and shareholders of each company, allowing to assess the degree of efficiency of the latter in managing shareholders' capital. According to Abebe and Abera (2019), ROE measures the rate of return on equity and is calculated using the quotient between the companies' net income and the value of equity. This indicator is not chosen frequently to analyse the financial performance of insurers, however, is used in two of the papers reviewed, Abebe and Abera (2019) and Batool and Sahi (2019).

Financial performance, analysed using the two indicators mentioned above, can be studied at the microeconomic and macroeconomic level. Profitability can be explained by internal factors, represented by the specific factors of insurance companies, or by external factors, which refers to indicators of the economic environment.

Microeconomic Variables

Financial performance, analysed using the two indicators mentioned above, can be studied at a microeconomic and macroeconomic level. The microeconomic variables, most used by researchers and included in this article are leverage, premium growth, size, age, and loss ratio.

Leverage

According to Ajao and Ogieriakhi (2018), financial leverage reveals the extent at which borrowed funds are being used by a company, and the risk of bankruptcy arises when a firm that is highly levered finds it difficult to make debt payments. In most studies, leverage is calculated using the ratio between total liabilities and equity. According to Abebe and Abera (2019), Almajali et al. (2012), Batool and Sahi (2019), Burca and Batrînca (2014), Mehari and Aemiro (2013) the leverage significantly impacts the insurance performance. However, conclusions about the effect of financial leverage on profitability have been mixed. For Almajali et al. (2012), Batool and Sahi (2019), Mehari and Aemiro (2013) and Puławska (2021) leverage has a positive relationship with the financial performance. Malik (2011) and Burca and Bratînca (2014) state that the relationship is inverse. On the other hand, Ajao and Ogieriakhi (2018), Berhe and Kaur (2017), Berteji and Hammami (2016), Derbali and Jamel (2019) and Malik (2011) proved the existence of a statistically insignificant relationship.

Premium growth

Premium growth variable measures the rate of insertion of insurance companies in the market (Burca and Batrînca, 2014). The value of this variable can be obtained through the variation verified in the premiums earned net of reinsurance, between two consecutive years. Regarding this variable, Burca and Batrînca (2014) and Derbali and Jamel (2019) found a significant non-positive relationship between this variable and the profitability of insurers. Berteji and Hammami (2016) also confirm the existence of a significant, yet positive, relationship. Ajao and Ogieriakhi (2018) and Mehari and Aemiro (2013) concluded a positive relationship, however, statistically insignificant.

Size

The company size affects its performance in different ways. Larger firms have the advantage of being able to exploit economies of scale, and scope, and thus being more efficient compared to small companies. Small companies are more likely to have difficulties in competing with large companies, in very competitive markets, because they have less power. On the other hand, as firms become larger, they might present inefficiencies, leading to lower financial performance (Almajali et al., 2012).

Abebe and Abera (2019), Almajali et al. (2012), Batool and Sahi (2019), Berhe and Kaur (2017), Burca and Batrînca (2014), Malik (2011) and Mehari and Aemiro (2013) found that the size has a significant and positive influence on profitability ratios. Almajali et al. (2012) also stated that, for insurance companies to improve their financial performance, they must increase the volume of assets. In contrast, Ajao and Ogieriakhi (2018) and Berteji and Hammami (2016) concluded that the relationship was indeed significant, however negative. Additionally, for Derbali and Jamel (2019), the influence of the dimension variable on profitability is negative but statistically insignificant, and Puławska (2021) who, although classifying the relationship as positive, concludes it is statistically insignificant. Regarding the calculation of the dimension variable, most authors use the natural logarithm of total assets.

Age

Age variable, as its name suggests, refers to the number of years the insurer has been established in the market. Abebe and Abera (2019), Ajao and Ogieriakhi (2018), Berteji and Hammami (2016) and Derbali and Jamel (2019) found a significant relationship between profitability and Age. Abebe and Abera (2019) and Derbali and Jamel (2019) stated that the relationship is negative, the other authors said it is positive. Almajali et al. (2012), Burca and Batrînca (2014), Malik (2011) and Mehari and Aemiro (2013) concluded the age variable does not influence the insurer's performance.

Loss Ratio

Loss ratio can be calculated using the quotient between the incurred claims and the total earned premiums, both gross or net of reinsurance. Abebe and Abera (2019), Burca and Batrînca (2014), Malik (2011) and Mehari and Aemiro (2013) proved the existence of a particularly significant negative relationship between risk and financial performance. Berhe and Kaur (2017), even though agreeing the influence of this ratio on profitability would be negative, classified it as statistically insignificant.

Macroeconomics Variables

In addition to microeconomic variables, there are several studies that suggest that external factors of the macroeconomic environment, such as the gross domestic product (GDP) and the inflation rate, are possible important indicators in explaining the profitability of insurance companies.

GDP

GDP represents the market value of all finished goods and services produced in a country during a year and, generally, an increase in this indicator causes an increase in companies' profitability (Derbali and Jamel, 2019). Abebe and Abera (2019), Berhe and Kaur (2017), Burca and Batrînca (2014) and Derbali and Jamel (2019) use annual GDP growth as a representative measure of this variable, while Batool and Sahi (2019) chose to use annual GDP exact value. Batool and Sahi (2019) and Berhe and Kaur (2017) concluded that GDP has a positive and statistically significant impact on financial performance. Derbali and Jamel (2019) also observed a positive relationship between the GDP and the profitability of insurance companies, however insignificant. Abebe

and Abera (2019) and Burca and Batrînca (2014) proved the impact of GDP on profitability is negative, but statistically insignificant.

Inflation

Inflation is defined as a persistent and substantial increase in the general level of prices. The increase in prices tends to reduce total household expenditures, which, in turn, lead to lower GDP and reduce the wealth available to households (Derbali and Jamel, 2019). Abebe and Abera (2019), Berhe and Kaur (2017) and Derbali and Jamel (2019) argue that inflation does not significantly affect profitability. Abebe and Abera (2019) concluded that, although with a non-significant impact, the increase in inflation causes an increase in the return on assets ratio.

3. METHODOLOGY

3.1. SAMPLE

In order to obtain a representative sample of insurance companies operating in Portugal, which enables the present study of the impact of the pandemic on their profitability, as well as its determinants, accounting information from 14 non-life insurance companies was collected, with the largest market share in Portugal, out of a universe of 66 entities that operated in the Portuguese insurance sector in December 2020. Although the sample only represents 21.21% of the total number of insurers established in Portugal, it represents approximately 83.4% of the national insurance activity, measured by the direct insurance premiums, ensuring a good representation of the Portuguese insurance sector. The time horizon of the study is from 2004 to 2020. Thus, the final sample is composed by a total of 14 non-life insurers over a period of 17 years, which is equivalent to a total of 238 observations. The data used for the years between 2004 and 2019 were taken from the databases available at ASF website. To obtain data for 2020, it was necessary to use the annual reports of each company. Regarding macroeconomic data, the databases available on the Pordata portal were used. In carrying out the statistical treatment, Microsoft Office Excel and the statistical software R Studio were used.

Due to the existence of some mergers between relevant insurers in the Portuguese insurance market during the period of investigation, it was necessary to make some adjustments to the data of some companies. Regarding the company Fidelidade, given that it resulted from the merger by incorporation of Império Bonança into Fidelidade Mundial, in 2011, it was decided to add to Fidelidade's data those of Império Bonança. Additionally, given the acquisition of Seguradoras Unidas by the Generali group, Generali's data incorporates data from the companies Açoreana, Generali, Generali Vida, Logo, Tranquilidade and T-Vida.

3.2. RESEARCH VARIABLES AND MODEL SPECIFICATION

Regarding the variables used in the investigation, the list and description of each one of them is presented below. The choice was based on the theoretical framework carried out in section 2.2.

Table 1 – Presentation and description of each variable present in the investigation

Variables	Description/Formula	Expected Sign
ROA	$\text{ROA} = \frac{\text{Net Income}}{\text{Total Assets}}$	n/a
ROE	$\text{ROE} = \frac{\text{Net Income}}{\text{Total Equity}}$	n/a

COVID-19	0, between 2010 and 2019 1, in 2020	–
Leverage	$\text{Leverage} = \frac{\text{Debt}}{\text{Total Equity}}$	–
Premium Growth	$\text{Premium Growth}_t = \frac{\text{Premium}_t - \text{Premium}_{t-1}}{\text{Premium}_{t-1}}$	+
Size	$\text{Size} = \ln(\text{Total Assets})$	+
Age	Number of years operating in the market	+
Loss Ratio	$\text{Loss Ratio} = \frac{\text{Incurred Claims}}{\text{Earned Premiums}}$	–
GDP Growth	Real GDP Annual Growth rate	+
Inflation	Annual Inflation rate	–

Source: Prepared by the author.

To fulfil the main objective, the following econometric models were designed, created from the variables presented above:

Model 1: $\mathbf{ROA_{it}} = c + \beta_1 * \text{COVID} - 19_t + \beta_2 * \text{Leverage}_{it} + \beta_3 * \text{Premium Growth}_{it} + \beta_4 * \text{Size}_{it} + \beta_5 * \text{Age}_{it} + \beta_6 * \text{Loss Ratio}_{it} + \beta_7 * \text{GDP Growth}_{it} + \beta_8 * \text{Inflation}_{it} + \varepsilon_{it}$

Model 2: $\mathbf{ROE_{it}} = c + \beta_1 * \text{COVID} - 19_t + \beta_2 * \text{Leverage}_{it} + \beta_3 * \text{Premium Growth}_{it} + \beta_4 * \text{Size}_{it} + \beta_5 * \text{Age}_{it} + \beta_6 * \text{Loss Ratio}_{it} + \beta_7 * \text{GDP Growth}_{it} + \beta_8 * \text{Inflation}_{it} + \varepsilon_{it}$

where $\mathbf{ROA_{it}}$ e $\mathbf{ROE_{it}}$ represent the two profitability indicators under analysis, the dependent variables; $\boldsymbol{c}$ represents the constant term of the regression; $\mathbf{Covid-19_t}$ represents the binary explanatory variable that takes the value 0 for the pre-pandemic period, 2004-2019, and the value 1 for the pandemic period, 2020; $\mathbf{Leverage_{it}}$, $\mathbf{Premium\ Growth_{it}}$, $\mathbf{Size_{it}}$, $\mathbf{Age_{it}}$, $\mathbf{Loss\ Ratio_{it}}$ $\mathbf{GDP\ Growth_{it}}$ e $\mathbf{Inflation_{it}}$ are the control variables and represent the factors that might influence profitability; $\boldsymbol{\beta_{1,2,3..,8}}$ represent the coefficients of the independent variables, to be estimated; $\boldsymbol{\varepsilon_{it}}$ corresponds to the regression error, the residuals; and $\boldsymbol{it}$ refers to insurer i (sectional units) in year t (time), with i=1,…,15 and t=2004,…,2020.

3.3. RESEARCH METHODOLOGY

In the empirical analysis realization, the work developed by Abebe and Abera (2019), Ajao and Ogieriakhi (2018), Berhe and Kaur (2017), Derbali and Jamel (2019), Mehari and Aemiro (2013) and Puławska (2021) is very relevant.

The methodology implemented was the linear regression method, using a panel data model. The panel data technique comprises databases with multiple observations for each individual in and allows for better estimates and testing of more sophisticated behavioral models, with less restrictive assumptions (Batalgi, 2005). According to Derbali and Jamel (2019), this model has the property of combining two dimensions, the transversal dimension that is to say individual and the longitudinal dimension that is to say temporal. This way, we can analyse the changes in variables over time, between different individuals, and these individuals can be of different types. When using panel data, we have several available estimators that can be used to obtain the coefficients of a given model. According to Berhe and Kaur (2017), the most appropriate ones are the fixed effects and random effects models. Additionally, we can use the ordinary least squares method for the pooled model (Pooled OLS).

According to Park (2011), to determine which of the estimators is more appropriate to determine the coefficients in a panel data model, it is necessary to carry out three different tests: the F test, that tests the fixed effects model, the Breusch-Pagan test (Lagrange Multiplier), that tests the random effects model and the Hausman test, that compares the random effects model with the fixed effects model.

Accordingly, the F test was first performed to evaluate the null hypothesis that all sectional units have the same intercept. If the p-value obtained in the F test is low, the hypothesis that determines the pooled least squares model (Pooled Least Squares) as the most appropriate is rejected, validating the alternative hypothesis of the existence of fixed effects. Subsequently, the Breusch-Pagan test was performed, which compares the pooled model with the random effects model. A low p-value demonstrates there is evidence to accept the alternative hypothesis that the random effects model is the most adequate. Finally, to determine which of the estimators is more appropriate to determine the model coefficients, either fixed or random effects, the Hausman test was used. According to Gujarati and Porter (2011), if there is evidence to reject the null hypothesis, we can conclude the random effects model is not appropriate, and we should use the fixed effects model.

In the present study, it is assumed that the data are, asymptotically, normally distributed through the application of the central limit theorem. This theorem states that data that are not normally distributed approximate to a normal distribution, regardless of their original distribution, as long as the sample is large enough. (Wooldridge, 2012)

Additionally, in order to ensure the reliability and robustness of the model, the existence of Multicollinearity, Heteroscedasticity and Autocorrelation problems was tested.

Multicollinearity is a problem that can occur in regressions where independent or explanatory variables are highly correlated with each other. Thus, similarly to what was done by Ajao and Ogieriakhi (2018), Berhe and Kaur (2017) and Burca and Batrînca (2014), it was decided to start by analysing the correlation matrix between the variables under study, observing the value of their correlation coefficients. According to Kennedy (2008), if any of the correlation coefficients between the variables is greater than 0.70, we may be facing a multicollinearity problem. Then, based on the work of Abebe and Abera (2019), Almajali et al. (2012) and Mehari and Aemiro (2013), a multicollinearity test was performed using the Variance Inflation Factor (VIF). According to Almajali et al. (2012), if the VIF value for any variable under study is less than 0.1 or greater than 10, it may indicate the existence of a correlation coefficient greater than 0.9 with other variables, indicating the existence of a multicollinearity problem.

Heteroscedasticity is verified when the error terms variance, the residuals, is not constant between individuals. There are several tests that can be used to detect the presence of heteroscedasticity, however, similarly to what was performed by Abebe and Abera (2019), Derbali and Jamel (2019) and Mehari and Aemiro (2013), the Breusch Pagan/Cook-Weisberg test will be used. We decided to implement a robust version of this test, developed by Koenker and Basset (1982), called the Studentized Breusch-Pagan test, which produces asymptotically correct significance levels for a comprehensive class of distributions. The null hypothesis underlying this test is the homoscedasticity of the residuals, so that a p-value lower than the 5% significance level suggests the presence of this problem.

Finally, the existence of autocorrelation, an assumption of linear regression models that is based on the idea that the residuals must be independent, was verified using the Breusch-Godfrey/Wooldridge test. The null hypothesis underlying the test is exactly the non-existence of

a serious correlation of any order, so that its rejection indicates the existence of correlation between the residuals. (Gujarati and Porter, 2011)

In case of detection of heteroscedasticity or autocorrelation problems in the model, we should use standard errors that are robust to it.

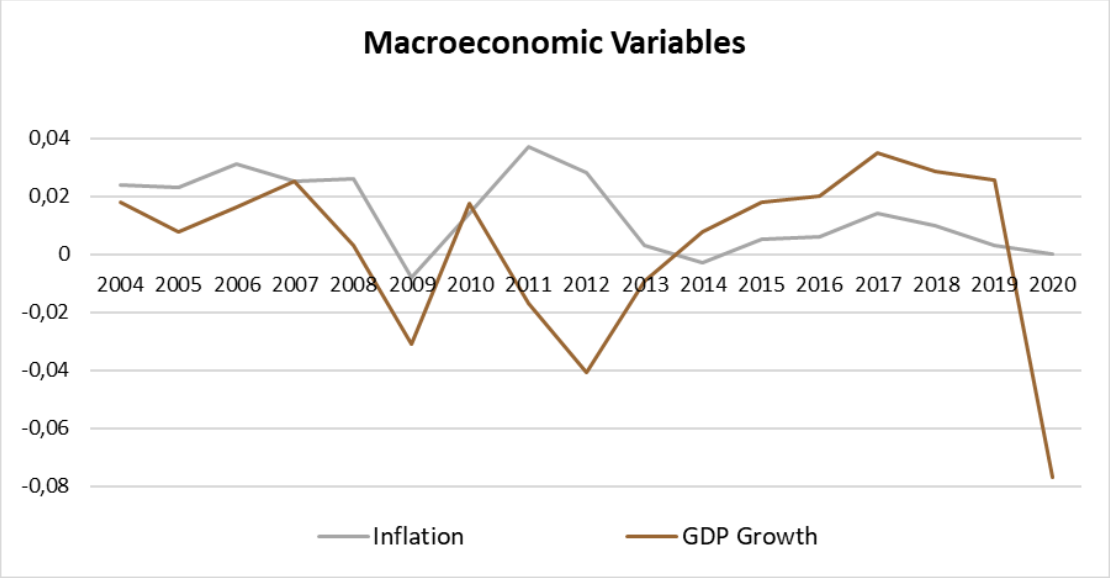
4. RESULTS AND DISCUSSION

4.1. DESCRIPTIVE ANALYSIS

Macroeconomic Variables

In the following graph, we can observe the temporal evolution of the two economic variables present in the study, inflation, and GDP growth.

Figure 1 - Temporal evolution of independent macroeconomic variables



Source: Prepared by the author using data from the Pordata website.

Regarding the GDP growth variable, in Portugal, it shows large fluctuations during the period under analysis. It reaches its lowest and negative values in 2009, 2012 and 2020. The value of this variable was only negative in the indicated years and in 2013, the years of the financial crisis and the COVID-19 pandemic. The maximum growth observed was in 2017.

Over the period under analysis, there is some instability regarding the Inflation variable, similarly to what happens with the GDP growth variable. We can see the value of this variable started to grow in 2009, reaching its highest value in 2011, having started to decrease from that same year until 2014. Between 2014 and 2017, the trend was increasing, however, from 2018 it started decreasing again until 2020. The smallest values were observed in 2009, 2014 and 2020.

In the following table we can observe the descriptive statistics of the independent macroeconomic variables.

	Mean	Median	Maximum	Minimum	Standard Deviation	N
GDP Growth	0,0028	0,0163	0,0351	-0,0770	0,0294	17
Inflation	0,0140	0,0140	0,0370	-0,0080	0,0133	17

Table 2 – Macroeconomic Variables Descriptive Statistics between 2004 and 2020
(**Source**: Prepared by the author based on R Studio output).

According to table 2, on average, the Portuguese GDP grew by 0.0028 during the last 17 years. The maximum GDP growth verified was 0.0351, and the minimum growth observed was -0.0770, in 2017 and 2020, respectively, as shown in Figure 2. With the standard deviation equal to 0.0294, we can deduce that there are no large discrepancies in the values of GDP growth, relative to the average, over the period.

Inflation in Portugal during the last 17 years was, on average, equal to 0.0140. The standard deviation of the inflation variable is equal to 0.0133, revealing that there is not a large dispersion of data in relation to the average, with its values ranging between -0.0080 and 0.0370, minimum and maximum values, respectively.

Microeconomic Variables

The descriptive statistics of the variables, referring to the insurance activity in the non-life branch, to be included in the statistical models, are presented in the following table.

	Mean	Median	Maximum	Minimum	Standard Deviation	N
ROA	0,0164	0,0178	0,1096	-0,2307	0,0439	238
ROE	0,0166	0,0842	0,5653	-2,7423	0,3657	238
Leverage	5,1793	4,2894	31,7368	0,8586	4,0039	238
Premium Growth	0,02	0,0226	0,9965	-2,0999	0,2223	238
Size	12,6786	12,226	16,6359	10,8219	1,5099	238
Age	61,9286	32	212	7	57,3738	238
Loss Ratio	0,7155	0,7243	1,2438	0,2735	0,1217	238

Table 3 - Macroeconomic Variables Descriptive Statistics between 2004 and 2020
(**Source:** Prepared by the author based on R Studio output).

Regarding to ROA variable, the return on assets, its values are concentrated between -0.2307 and 0.1096, with an annual average of 0.0164. These values, minimum and maximum, indicate that the most profitable insurer achieved 10.96% of net income per unit of investments in assets, while the least profitable one registered a loss of -23.07%, per unit of investments in assets, which demonstrates some inefficiency of the insurer using its assets.

In the case of the dependent variable ROE, the companies under investigation, in the period under analysis, present an average return of 0.0166, a value very similar to what we observed for ROA variable. In practical terms this means that, on average, insurance company shareholders obtained a rate of return of 1.66% on invested capital. The least profitable company lost -2.7423, while the most profitable company had a return on equity ratio equal to 0.5653.

As for the leverage indicator, it appears that, on average, the insurance companies under study have a leverage of 5.1793 in the period under analysis, indicating that insurance companies are

leveraged because they use debt instead of capital for financing purposes. The high value of the standard deviation, 4.0039, denotes the existence of large differences between the level of leverage of the research insurance companies.

The minimum and maximum values of premiums growth observed for the companies under study, in the period under analysis, was -2.0999 and 0.9965, respectively. The premiums earned, net of reinsurance, of insurance companies, in average terms, show an annual growth of 0.02.

Observing the size variable statistics of the companies in the sample, the results reveal that, on average, they have a total assets logarithm of 12.6786. From the standard deviation value, equal to 1.5099, we can deduce there is a high dispersion of size insurance companies' data over the period under analysis, in relation to the average.

Regarding the age variable, this is, on average, equal to 61.9286 years. The longest established insurer in the insurance market is 212 years old, while the insurer with fewest years of operation in this industry has 7 years, during the period under study. This variable has the highest standard deviation, 57.3738, demonstrating the existence of significant differences in the age of insurers.

The loss ratio of insurance companies between 2004 and 2020 was, on average, 71.55%. This reveals that, on average, Portuguese non-life insurance companies paid 71.55% of the earned premiums for incurred claims, both net of reinsurance. The highest loss ratio verified was 124.38% and the lowest was equal to 27.35%.

Table 4 – P-value related to model selection tests
(**Source:** Prepared by the author based on R Studio output).

4.2. MODEL SELECTION

	Model 1 - ROA	Model 2 - ROE
F test	0,00000	0,00008
Breusch-Pagan test	0,00000	0,00736
Hausman test	0,22400	0,05457

In the following table, we can see the p-value results of the tests performed, taken from the outputs obtained in the R software, for models 1 and 2, which allow us to select the model that best fits the data.

In order to test the fixed effects model, the F test was performed. Having obtained a p-value very close to 0, in both models, we can consider that there is evidence, at the 5% significance level, to state that there are fixed effects in both models 1 and 2. Thus, we confirmed the fixed effects model is the most appropriate, in deterioration pooled OLS, for both models under analysis.

Then, the Breusch-Pagan test was used, to compare the Pooled OLS model with the random effects model. Since the p-value for model 1 is approximately equal to 0 and for model 2 equal to 0.00736, we consider there is evidence, with 95% confidence, to say the random effects model is better to the data.

Finally, it was necessary to perform the Hausman test for the two econometric models to decide between the fixed-effects or random-effects estimator. We can state that the p-value is higher than 5% in both models and, as such, there is evidence to state the random effects model is the most appropriate one for the models under study.

4.3. MODEL ASSUMPTIONS

MULTICOLINEARITY

To test the existence of a multicollinearity problem, we started by analysing the correlation matrix between the dependent and independent variables of the investigation.

	ROA	ROE	COVID-19	Leverage	Premium Growth	Size	Age	Loss Ratio	Inflation	GDP Growth
ROA	1									
ROE	0.841	1								
COVID-19	0.073	0.063	1							
Leverage	-0.442	-0.5	-0.107	1						
Premium Growth	0.032	-0.003	-0.041	-0.07	1					
Size	-0.116	0.021	0.049	0.491	-0.062	1				
Age	-0.11	0.068	0.035	0.325	-0.005	0.83	1			
Loss Ratio	-0.655	-0.597	-0.096	0.247	0.001	0.004	-0.014	1		
GDP Growth	0.02	0.06	-0.271	0.092	-0.053	-0.052	-0.05	0.019	1	
Inflation	0.066	0.006	-0.699	0.144	0.123	-0.03	-0.011	0.004	0.143	1

Table 5 – Correlation Matrix
(**Source:** Prepared by the author based on R Studio output).

Analysing the matrix in table 6, we can see that the variable COVID-19 has a negative relationship with the microeconomic variables, in accordance with what was expected and, additionally, with the leverage, premium growth and loss ratio variables. Note that the two dependent variables of the study, ROA and ROE, are highly correlated.

According to the correlation matrix, we can verify we only have a correlation coefficient greater than 0.7, around 0.83, in the independent variables, between age and size, which may indicate the existence of a multicollinearity problem. For the remaining independent variables under study, there is no correlation coefficient greater than 0.7.

In order to complement the analysis to the correlation matrix, it was decided to perform a multicollinearity test using the Variance Inflation Factor (VIF). Thus, in the following table we can observe the values obtained for this factor, for each variable and for both models.

	Model 1 - ROA	Model 2 - ROE
COVID-19	2.18	2.14
Leverage	1.16	1.24
Premium Growth	1.04	1.04
Size	4.32	3.29
Age	4.28	3.11
Loss Ratio	1.11	1.11
GDP Growth	1.15	1.11
Inflation	2.09	2.08

Table 6 – Variance inflation factors (VIF) for explanatory variables
(**Source:** Prepared by the author based on R Studio output).

In table 7, we can see the VIF value is always less than 5, regardless of the independent variable, ROA or ROE, so, considering that most authors establish a limit of 10 for the value of this factor, we can affirm the non-existence of the multicollinearity problem. Note that the values of this

factor are higher for the dimension and age variables, which corroborates the results obtained through the correlation matrix analysis.

HETEROCEDASTICITY AND AUTOCORRELATION

In the following table we can observe the p-values for each of the tests performed on the model, for each of the dependent variables, taken from the outputs obtained in the R software.

	Model 1 - ROA	Model 2 - ROE
Studentized Breusch-Pagan test (Heterocedasticity)	6.367e-08	7.291e-08
Breusch Godfrey/Wooldridge test (Autocorrelation)	5.942e-09	7.583e-07

Table 7 – P-value for Heteroscedasticity and Autocorrelation tests
(**Source:** Prepared by the author based on R Studio output)

Regarding Studentized Breusch-Pagan test, which reveals the presence of heteroscedasticity, for any of the dependent variables, the p-value is approximately equal to 0, so there is evidence to reject the null hypothesis that the error variances are all equal. Thus, heteroscedasticity is a present problem.

Regarding the Breusch Godfrey/Wooldridge test, which controls the presence of autocorrelation of the residuals of the estimated model, for any of the dependent variables, similarly to what was seen in the previous test, the p-value is very close to 0, so there is evidence to conclude there is independence between the residual variables. Thus, autocorrelation is present in the data.

Consequently, once the presence of heteroscedasticity and autocorrelation was detected, it is necessary to implement some adjustments to the model in order to obtain a robust model. The software used in the statistical analysis provides a corrective measure[1], which applies a robust covariance matrix estimator to heteroscedasticity and autocorrelation problems, thus correcting both problems (Croissant et al., 2021).

The used corrective measure allows us to obtain standard errors robust to heteroscedasticity and autocorrelation, simultaneously, and was developed by Newey and West (1987). According to Gujarati and Porter (2011), the Newey-West method, that corrects autocorrelation problems, is an extension of White's method, which allows obtaining consistent standard errors for heteroscedasticity.

4.4. REGRESSIONS RESULTS

The following table shows the results of the final models obtained for each of the dependent variables under analysis, with a random effects estimator, robust to the problems of heteroscedasticity and autocorrelation by the Newey-West method.

	Model 1 - ROA			Model 2 - ROE		
Variables	**Coefficients**	**Standard Errors**	**p-value**	**Coefficients**	**Standard Errors**	**p-value**
Constant	0,13170	0,06856	0,05473 .	0,45640	0,49960	0,36096
COVID-19	0,02803	0,00830	0,00073 ***	0,11040	0,07356	0,13339
Leverage	-0,00252	0,00062	0,00004 ***	-0,05047	0,00879	0,00000 ***

[1] Command vcovNW.plm: Newey and West (1987) *Robust Covariance Matrix Estimator*

Premium Growth	0,00252	0,01030	0,80653	-0,04742	0,10021	0,63609
Size	0,00338	0,00531	0,52367	0,05950	0,03579	0,09645 .
Age	-0,00013	0,00016	0,40079	0,00012	0,00081	0,87989
Loss Ratio	-0,19891	0,04881	0,00005 ***	-1,40169	0,48946	0,00419 **
GDP Growth	0,30180	0,07502	0,00006 ***	1,64347	0,57018	0,00395 **
Inflation	0,21181	0,14236	0,13680	3,74367	1,20037	0,00182 **
Observations	238			238		
R^2	0,5078			0,5239		
Adjusted R^2	0,4906			0,5073		
F-Test	66,6283		0,00000 ***	48,3841		0,00000 ***

Caption: . indicates that the coefficient is statistically significant at 10% significance level; * indicates that the coefficient is statistically significant at 5% significance level; ** indicates that the coefficient is statistically significant at 1% significance level; *** indicates that the coefficient is statistically significant for all significance levels.

Table 8 – Estimation of random effects models, with robust standard errors according to the Newey-West method, for the dependent variable ROA and ROE.
(**Source:** Prepared by the author based on R Studio output).

Regarding model 1, the value of R^2 statistic reveals that the independent variables explain 50.78% of the variations of the entire panel. The model has an adjusted coefficient of determination (adjusted R^2) of 49.06%, which means the variation in the variables included in the estimation of this model explains 49.06% of the variations observed in the return on the asset. The model presents a significant statistic for the F test, at a significance level of 5%. This test aims to test the joint significance of the independent variables selected for the study. Thus, in the above model, we accept with 95% confidence that the selected variables form a good model.

About model 2, the value of the R^2 statistic shows the independent variables explain 52.39% of the variations of the entire panel. The model has an adjusted coefficient of determination (adjusted R^2) of 50.73%, which means the variation in the variables included in the estimation of this model explains 50.73% of the variations in the return on equity. The model presents a significant statistic for the F test, at the significance level of 5%, thus forming a good model.

Next, we proceed to the analysis of each of the variables. We opted for a joint analysis of the models due to the similarities observed.

COVID-19

The most relevant variable in the study, which provides an answer to the central question of this article, is COVID-19, as it captures the pandemic impact on the profitability ratios, ROA and ROE, registered by insurance companies. The coefficient of the COVID-19 variable has a positive sign, suggesting the pandemic had a positive impact on insurance companies by increasing their respective profitability ratios, contrary to what was expected at the beginning of the study. However, we note that this impact was only statistically significant for the 5% significance level, in model 1, whose dependent variable is ROA. In model 2, the relationship between COVID-19 and ROE, although positive, is not statistically significant.

This conclusion is quite curious because, according to the literature review, it was expected that COVID-19 would negatively impact the insurance industry, however, this was not verified. In practical terms, 2020 was a year in which insurers had higher asset return ratios, thus contradicting initial expectations. In particular, this result is not in accordance with what Pulawska (2021) obtained. Pulawska (2021) analysed the impact of COVID-19 on the profitability of the assets of insurance companies operating in some European countries, having concluded a negative and significant impact, contrary to what was obtained for companies operating in Portugal.

By the end of the 2020, the provisional net results of insurance companies under the prudential supervision of the ASF exceeded the value of €458 million (of the 38 insurance companies, 35 show positive values), thus showing a growth of 51.6%, in relation to 2019 (ASF, 2021). According to José Galamba de Oliveira, APS President, the insurance sector showed a very positive response capacity and, although there was a drop in insurance production, it managed to maintain its financial strength. The president assured that, until March 2021, insurers did not feel any problem in terms of liquidity risk. (Norinha, 2021)

Leverage

The results obtained demonstrate there is a negative relationship between financial leverage and the performance of insurance companies. The relationship is considered statistically significant because the p-value, in both models, is significant, lower than the 5% significance level. This result suggests insurance companies operating in Portugal, in the non-life branch, with a higher level of leverage, have a worse financial performance than the others, and according to Abebe and Abera (2019), that financing using capital is better than debt financing.

Burca and Bratînca (2014), who defined leverage as the ratio between net technical reserves and equity and consider that leverage reflects the potential impact on equity of a deficit in technical reserves in the event of unexpected losses, also concluded that more leveraged firms are less profitable. Additionally, the result obtained is in accordance with what was initially expected, and the same conclusion was obtained in the studies by Abebe and Abera (2019), Burca and Bratînca (2014) and Malik (2011), who argue that the relationship between leverage and profitability is negative and statistically significant.

Premium Growth

Premium growth variable coefficient reveals a positive relationship with the return on assets of insurance companies, as expected, and a negative relationship with the return on equity. However, this relationship is not significant for either model, as the p-value is greater than 5% for both. Therefore, an increase or decrease in the level of earned premiums, net of reinsurance cannot be considered to significantly impact the financial performance of non-life insurance companies in Portugal.

Ajao and Ogieriakhi (2018), Berteji and Hammami (2016) and Mehari and Aemiro (2013) also found a positive relationship between these variables, however, only Ajao and Ogieriakhi (2018) and Mehari and Aemiro (2013) proved its statistically insignificance, a conclusion identical to that obtained in the present study for model 1. Among the literary review, Burca and Bratînca (2014) and Derbali and Jamel (2019) were the only authors to prove the relationship between the premiums growth and profitability was negative, similarly to what was obtained for model 2, however, both claim it is statistically significant.

Size

The regression results reveal the existence of a positive relationship between firm size and profitability ratios, however, statistically insignificant, with a 5% confidence level. It would be expected, given that size represents the natural logarithm of total assets, it would have a significant impact on profitability ratios. However, for the Portuguese insurance market, in the period under study, that is not verified, being insignificant in their explanation, with 95% confidence. The positive relationship observed reveals that an increase in the value of the total asset logarithm leads to an increase in profitability. This means the largest insurers are more efficient than the smaller insurers, in the Portuguese insurance sector.

Among the literature, most authors, apart from Ajao and Ogieriakhi (2018), Berteji and Hammami (2016) and Derbali and Jamel (2019), concluded a positive relationship between size and performance, similar to what was obtained in the present study. However, only Derbali and Jamel (2019) and Puławska (2021) proved the existence of a statistically insignificant relationship, also, Puławska was the only author defending the relationship was positive, similarly to the result we obtained in this investigation.

Age

The company's age, another control variable, measures the total number of years the insurer has been established in the market. In the model whose dependent variable is the ROA, the coefficient obtained for age variable is positive, as expected, suggesting that an insurer with more experience is more efficient using its assets. On the other hand, the coefficient is negative for the model with ROE as dependent variable, contrary to what was initially expected, revealing that a more recent insurer should not pay particular attention to age, due to this negative relationship obtained between the return on equity and age.

A statistically insignificant relationship was also obtained by Almajali et al. (2012), Burca and Batrînca (2014), Malik (2011) and Mehari and Aemiro (2013), all of which concluded the existence of an inverse relationship, similar to what was obtained in this study, for model 2. Ajao and Ogieriakhi (2018) and Berteji and Hammami (2016) proved the existence of a positive relationship, however none of them classified it as insignificant.

Loss Ratio

The estimation models revealed the existence of a negative relationship between loss ratio and insurers financial performance, as expected. The p-value, in both models, is less than 5% and, as such, the relationship is statistically significant for this significance level. This significant and inverse relationship was also verified in the studies developed by Abebe and Abera (2019), Burca and Batrînca (2014), Malik (2011) and Mehari and Aemiro (2013).

The result obtained is in accordance with what was initially expected, given that higher loss ratio reveals claims costs greater in relation to the earned premiums and, consequently, lower income for insurance companies. Additionally, a loss ratio above 100% suggests claims costs exceeded the revenue obtained through premiums.

GDP Growth

The effect of GDP growth on insurers' financial performance is positive, as initially expected. In both models, this variable is statistically significant at the 95% confidence level. The same result, positive and statistically significant relationship, was obtained by researchers Batool and Sahi (2019) and Berhe and Kaur (2017).

The positive coefficient estimated for this variable reveals that economic growth and profitability are directly and highly related. In other words, this means that economic growth enables insurers' performance, mainly through the increased need for financial services, thus increasing insurers' cash flows and profit margins. Whenever the economy evolves positively, the need for insurance services increases, which ultimately results in an increased return or profit margin for insurers. (Berhe and Kaur, 2017)

Inflation

The results of the regressions show that inflation has a positive impact on the profitability of insurance companies, which means, the higher as the inflation rate is, the more profitable the insurance companies are. The relationship is only statistically significant in the model in which ROE is the dependent variable.

Initially, inflation was expected to have a negative impact on profitability, as it represents a general increase in prices, decreasing the purchasing power available to households. However, it is important to focus on the companies' assets as well. According to Mercer (2021), the sense of impact may depend on the type of exposures maintained, as some investors believe the value of shares could be higher in a scenario of rising inflation, as they are less affected by higher discount rates (earnings and dividends are earned earlier).

Among the literature reviewed, only Abebe and Abera (2019) concluded the impact of inflation on the return on assets ratio was positive, however insignificant, similarly to what we obtained for the ROA variable. The other authors, who included the inflation variable in the study, concluded the existence of a negative and statistically insignificant relationship.

5. CONCLUSION

The main goal of the present investigation was to analyse the public health crisis impact on the insurance industry, in terms of profitability, as well as to determine the performance main explanatory factors. The empirical study focused on 14 insurance companies operating in the non-life branch in Portugal, between 2004 and 2020. Leverage, premium growth, size, age, and loss ratio were the internal factors used, while COVID-19, GDP growth and inflation were the external factors. In the present study, ROA and ROE were the two profitability measures used as dependent variables to be explained.

In order to model and identify the effect of the pandemic crisis, and a set of specific determinants of insurance companies, and the macroeconomic environment, mentioned in the previous paragraph, on the financial performance of the companies under study, panel data models were estimated. The panel data model used was the random effects model, which has been chosen after performing several selection tests.

Regarding the results, contrary to what was initially expected, COVID-19 had a positive impact on the profitability of non-life insurance companies in Portugal. Variable COVID-19 has a positive relationship with ROA and ROE, however, this relationship is only significant in the model whose dependent variable is ROA.

Regarding the regression results of model 1, with ROA as a dependent variable, it was concluded that leverage, loss ratio and GDP growth are important factors to explain the financial performance of insurers. Leverage and loss ratio have a negative impact, while GDP growth has a positive impact on ROA. All other factors are insignificant for the explanation of this profitability ratio. The explanatory variables included in the model explain 50.78% of the variation in ROA.

Regarding the regression results of model 2, ROE as a dependent variable, it was concluded that leverage, loss ratio, GDP growth and inflation are important variables in explaining the profitability of insurers. Leverage and loss ratio have an inverse relationship with ROE, while GDP growth and inflation positively impact profitability. All other factors are insignificant in explaining profitability as measured by ROE. The explanatory variables included explain 52.39% of the variation in ROE.

In summary, considering the conclusions mentioned above, non-life insurance companies should pay particular attention to factors such as their financial leverage, their loss ratio, and changes in macroeconomic factors, if they wish to be more efficient and profitable, given that fluctuations in these variables produce significant variations in the insurance companies' profitability.

Regarding the central question of this investigation, we can mention the unstable economic situation, observed worldwide in 2020 with the pandemic crisis, contrary to what was expected, came to positively impact the insurance sector, through the improvement of insurance ratios profitability recorded by insurance companies and, consequently, improving the financial performance of each one. In this way, it is possible to affirm the pandemic and the consequent economic slowdown, loss of human lives, as well as lock down were not factors with a negative influence on insurers financial performance, nor did induce them in significant losses.

The first limitation of the present study is the impossibility to fully incorporate the pandemic period, as well as the period that follows its end, and it is not possible to know yet when this will be possible, due to ignorance regarding the end date of this threat to the public health crisis. The second limitation is the fact that foreign insurers with high significance for the insurance market in Portugal were not included in the study, as their accounts are consolidated in the respective holding company.

As a possibility for further research, it is suggested to carry out the study by extending its period, to incorporate a greater number of years of the pandemic and to integrate the post-pandemic period into the investigation, making comparisons between different time periods. It is also suggested to include other variables, possibly important for the explanation of profitability, not used in this study, such as investments, liquidity, or tangibility of assets.

6. REFERENCES

Abebe, A. K., Abera, M.T. (2019). Determinants of Financial Performance; Evidence from Ethiopia Insurance Companies. *Journal of Accounting, Finance and Auditing Studies, 5*(1), 155-172.

Ahmed, N., Ahmed, Z., Usman, A. (2011). Determinants of performance: A case of life insurance sector of Pakistan. International Research Journal of Finance and Economics, 6(1), 123-128.

Ajao, M. G., Ogieriakhi, E. (2018). Firm Specific Factors and Performance of Insurance Firms in Nigeria. *Amity Journal of Finance, 3*(1), 14-28.

Almajali, A. Y., *et al*. (2012). Factors Affecting the Financial Performance of Jordanian Insurance Companies Listed at Amman Stock Exchange. *Journal of Management Research, 4(2)*, 266–289.

Alm, E., *et al.* (2006). Actuarial reflections on Pandemic risk and its consequences. European Actuarial Consultative Group, Oxford.

Al-Jafari, M. K., Al Samman, H. (2015). Determinants of Profitability: Evidence from Industrial Companies. *Canadian Center of Science and Education, 7*(16), 303-311.

APS. (2018). Seguros & Cidadania. Retrieved from https://www.apseguradores.pt/Portals/0/doc/publicacoes/Revista%20APS%2001_PT%20-%20FINAL.pdf?ver=2019-07-05-101014-453.

APS. (2020). Seguros & Cidadania. Retrieved from https://www.apseguradores.pt/Portals/0/doc/publicacoes/RevistaAPS05_PT.pdf?ver=2020-05-28-120430-560.

ASF. (2021). Relatório de Evolução da Atividade Seguradora. Retrieved from https://www.asf.com.pt/ISP/Estatisticas/seguros/estatisticas_trimestrais/historico/REAS_4T2020.pdf.

ASF. (2021). Impacto da pandemia COVID-19 na atividade não vida das empresas de seguros. Retrieved from https://www.asf.com.pt/NR/rdonlyres/2669B131-B564-474C-A9BC-03043C549A46/0/IPC19_2020.pdf.

Babuna, P., *et al.* (2020). The Impact of COVID-19 on the Insurance Industry. *International Journal of Environmental Research and Public Health, 17*(16).

Baltagi, B.H (2005). Econometric Analysis of Panel Data.

Batool, A., Sahi, A. (2019). Determinants of Financial Performance of Insurance Companies of USA and UK during Global Financial Crisis (2007-2016). *International Journal of Accounting Research, 7(*1).

Berhe, T. A., Kaur, J. (2017). Determinants of insurance companies' profitability Analysis of insurance sector in Ethiopia. *International Journal of Research in Finance and Marketing, 7*(4), 124-137.

Berteji, A., Hammami, S. (2016). The determinants of the performance of the life insurance companies in Tunisia. *International Journal of Economics, Commerce and Management, IV*(7), 334-343.

Burca, A., Batrînca, G. (2014). The Determinants of Financial Performance in the Romanian Insurance Market. *International Journal of Academic Research in Accounting, Finance and Management Sciences, 4*(1), 299–308.

Croissant, Y., *et al.* (2021). Package 'plm'. Retrieved from https://cran.r-project.org/web/packages/plm/plm.pdf. Acedido em 2 de agosto de 2021.

Derbali, A., Jamel, L. (2019). Determinants of the Performance of Insurance Companies in Tunisia. *Risk and Financial Management, 1*(1).

Dreyer, A., Kritzinger, G., Decker, J. (2007). Assessing the impact of a Pandemic on the Life insurance industry in South Africa*. Paper presented at the 1st IAA Life Colloquium, Stockholm.*

Epps, R.W., Cereola, S.J. (2008). Do institutional shareholders services corporate governance ratings reflect a company's operating performance? Critical Perspectives on Accounting, 19, 1135-1148.

Faga, H. A. (2006). Como conocer y manejar sus costos para tomar decisiones rentables.

Global Federation of Insurance Associations. (2020). Response to IAIS consultation on the impact of COVID-19. Retrieved from https://www.insuranceeurope.eu/response-iais-consultation-Covid-19-impact-insurance-sector.

Gujarati, D. N., Porter, D. C. (2011). Econometria Básica.

Kabajeh, M., *et al.* (2012). The Relationship between the ROA, ROE and ROI Ratios with Jordanian Insurance Public Companies Market Share Prices. *International Journal of Humanities and Social Science, 2*(11), 115-120.

Kennedy, P. (2008). A Guide to Econometrics.

Koenker, R., Basset, G. (1982). Robust tests for heterocedasticity based on regression quantiles. *Econometrica, 50*(1), 43-61.

Klonowska, A., Strupczewski, G. (2020). What Can the Covid-19 Pandemic Change in the Global Insurance Business? Identification of the Major Challenges. *Workshop Proceedings, 2830*.

KPMG. (2020). Retrieved from https://home.kpmg/xx/en/home/insights/2020/03/do-insurers-have-Covid-19-covered.html.

Lee, C. (2014). The effects of firm specific factors and macroeconomics on profitability of property-liability insurance industry in taiwan. *Asian Economic and Financial Review, 4*(5), 681-691.

Loannides, M. (2020). Insurance Risk Management During Pandemics. *Innovation in Business, Economics and Finance*, 245-256.

Malik, H. (2011). Determinants of Insurance Companies Profitability: An Analysis of Insurance Sector of Pakistan. *Academic Research International, 1(3),* 315–321.

Mehari, D., Aemiro, T. (2013). Firm Specific Factors That Determine Insurance Companies' Performance in Ethiopia. *European Scientific Journal, 9(10),* 245–255.

Mercer. (2021). Mitigating the inflation threat to insurers. Retrieved from https://www.mercer.com/our-thinking/wealth/mitigating-the-inflation-threat-to-insurers.html.

Newey, W., West, K. (1987). A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix. *Econometrica, 55*(3), 703-708.

Norinha, V. (2021). No Sector Segurador em Portugal 2021. *Jornal Económico.*

Ostroff, C. and Schmitt, N. (1993). Configuration of Organizational Effectiveness and Efficiency. *Academy of Management Journal*, *36*(6), 1345-1361.

Obasi, N. (2010). Policies, Challenges, Reforms and Nigerian Disposition to Insurance Contracts. *The Fronteira Post*, 1-6.

Park, H. (2011). Practical Guides to Panel Data Modeling: A Step by Step Analysis Using Stata. *International University of Japan*.

Pereira da Silva, C. (2000). Da Economia e da Gestão nas Empresas de Seguros.

Puławska, K. (2021). Financial Stability of European Insurance Companies during the COVID-19 Pandemic. *Journal of Risk and Financial Management, 14*(6), 266.

Stracke, A., Heinen, W. (2006). Influenza Pandemic: The Impact on an Insured Lives Life Insurance Portfolio. *The Actuary Magazine, 1.*

Swiss Re Institute (2020). World insurance: riding out the 2020 pandemic storm. Retrieved from https://www.swissre.com/institute/research/sigma-research/sigma-2020-04.html.

Thorburn, C., *et al.* (2020). COVID-19 Outbreak: Insurance implications and response. *World Bank Group.*

Wang, Y., *et al.* (2020). How Does COVID-19 Affect China's Insurance Market?. *Emerging Markets Finance and Trade 56*(10), 2350-2362.

Weisbart, S. (2006). Pandemic: Can the life insurance industry survive the avian flu?. *Insurance Information Institute, New York.*

Wooldridge, J. (2012). Introductory Econometrics: A Modern Approach.